

IN THE CLAIMS

1-8. (Canceled)

9. (Previously presented) A method of forming patterns in a semiconductor device comprising:

forming an insulation film on a substrate;

forming a conductive film on the insulation film;

forming a hard mask layer on the conductive film;

cleaning oxide residues generated in forming the hard mask layer from the hard mask layer using a first cleaning solution including sulfuric acid;

cleaning the oxide residues from the hard mask layer using a second cleaning solution including SC 1;

forming a photoresist pattern on the hard mask layer;

forming a hard mask by patterning the hard mask layer using the photoresist pattern; and

patterning the conductive film using the hard mask,

wherein forming the hard mask layer further comprises:

forming a first anti-reflective layer on the conductive film;

forming an oxide film on the first anti-reflective layer; and

forming a second anti-reflective layer on the oxide film.

10. (canceled)

11. (previously presented) The method of claim 9, wherein the oxide residues are generated by purging the second anti-reflective layers using a purge gas including nitrogen oxide in forming the second anti-reflective layer.

12. (previously presented) The method of claim 9, wherein the first and second anti-reflective layers include silicon oxide, silicon nitride or silicon oxynitride.

13. (previously presented) The method of claim 9, wherein a thickness ratio among the first anti-reflective layer, the oxide film and the second anti-reflective layer is about 1: 10: 2.5.

14. (Canceled)

15. (Previously presented) The method of claim 9, wherein cleaning oxide residues from the hard mask layer using the first cleaning solution including sulfuric acid is performed at a temperature of about 30 to about 70°C for about 3 to about 10 minutes.

16. (Canceled)

17. (Previously presented) The method of claim 9, wherein cleaning the oxide residues from the hard mask layer using the second cleaning solution including SC 1 is performed at a temperature of about 30 to about 70°C for about 5 to about 15 minutes.

18. (previously presented) A method of manufacturing a non-volatile memory device comprising:

forming a tunnel oxide film on a semiconductor substrate;

forming a first conductive film on the tunnel oxide film, the first conductive film being a floating gate of the non-volatile memory device;

forming an oxide/ nitride/ oxide film on the first conductive film;

forming a second conductive film on the oxide/ nitride/ oxide film, the second conductive film being a control gate of the non-volatile memory device;

forming a metal silicide layer on the second conductive film;

forming a hard mask layer on the metal silicide layer;

cleaning oxide residues generated in forming the hard mask layer from the hard mask layer using a first cleaning solution including sulfuric acid;

cleaning the oxide residues from the hard mask layer using a second cleaning solution including SC 1;

forming a photoresist pattern on the hard mask layer;

forming a hard mask by patterning the hard mask layer using the photoresist pattern; and

patterning the metal silicide layer, the second conductive film, and the oxide/ nitride/ oxide film and the first conductive film using the hard mask,

wherein forming the hard mask layer further comprises:

forming a first anti-reflective layer on the metal silicide layer;

forming an oxide film on the first anti-reflective layer; and

forming a second anti-reflective layer on the oxide film.

19. (canceled)

20. (previously presented) The method of claim 18, wherein a thickness ratio among the first anti-reflective layer, the third oxide film and the second anti-reflective layer is about 1: 10: 2.5.

21. (previously presented) The method of claim 18, wherein the first and the second anti-reflective layers include silicon oxide, silicon nitride or silicon oxynitride, and the oxide residues are generated by purging the second anti-reflective layer using a purge gas including nitrogen oxide in forming the second anti-reflective layer.

22. (Previously presented) The method of claim 18, wherein cleaning oxide residues from the hard mask layer using the first cleaning solution including sulfuric acid is performed at a temperature of about 30 to about 70°C for about 3 to about 10 minutes.

23. (Previously presented) The method of claim 18, wherein cleaning the oxide residues from the hard mask layer using the second cleaning solution including SC 1 is performed at a temperature of about 30 to about 70°C for about 5 to about 15 minutes.

24-27. (Canceled)